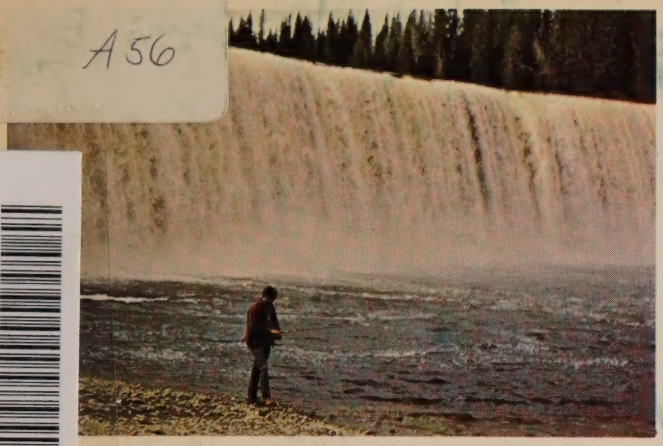


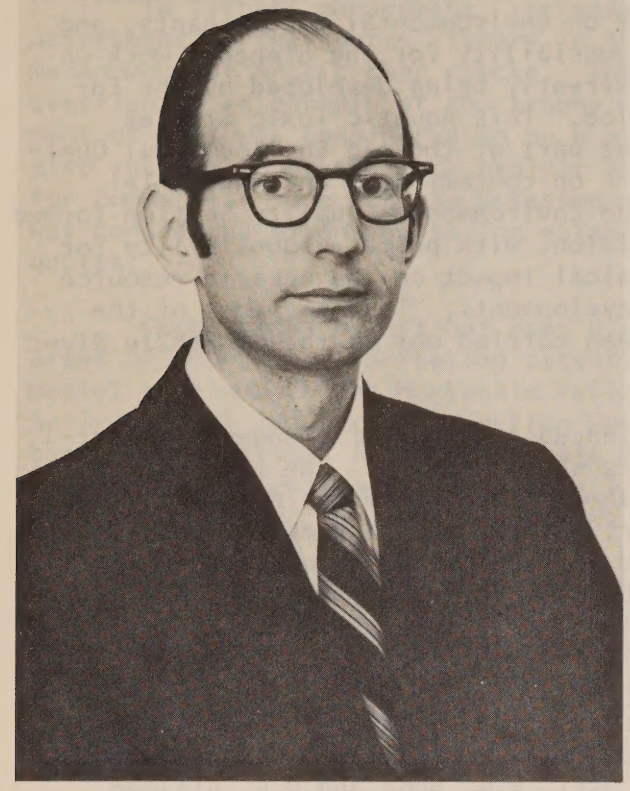
Annual Report 1972

RESOURCE MANAGEMENT BRANCH—CENTRAL REGION

Environment Canada
Fisheries and Marine Service

Environnement Canada
Service des pêches et des sciences de la mer

Winnipeg, Manitoba



FOREWORD

by

R.J. PATERSON
BRANCH CHIEF

The Resource Management Branch in the Central Region is, in its present form, of very recent vintage. The branch was formed in 1972, by amalgamation of what were then the Resource Development and the Conservation and Protection Branches. The Conservation and Protection Branch has played a key role in management of the Northwest Territories fisheries for many years, with most of its efforts centered upon the Great Slave Lake commercial fishery. The Resource Development Branch was created in 1970, with the appointment of L.J. Cowley as its Chief. Mr. Cowley laid the groundwork for the present programs in both fishery management and environmental quality, and his efforts stimulated the branch's participation in the Mackenzie Valley Pipeline Study.

Following amalgamation of the two branches, some reorganization was effected late in 1972. The new branch was divided into four 'divisions' with the units within these being known as

'sections'. The old Conservation and Protection Branch became the Enforcement Division and the previous Fishery Management Section became a division. A new division was created, headed by J.S. Loch, to carry out work on environmental contaminants, and in particular to assume responsibility for the branch's work on the Effluent Regulations, currently being developed by the Environmental Protection Service. This Aquatic Toxic Studies Division was formed from that part of the old Environmental Quality Section carrying out work on contaminants and industrial wastes. The remainder of the Environmental Quality Section formed the new Resource Impact Division, with prime responsibility for assessment of potential physical impact on the aquatic resource resulting from industrial developments. To date, most of the work of this division has been carried out in the Mackenzie River Valley.

The branch has experienced a number of changes and additions to its staff during its short history. The branch organization at the end of 1972 is shown on an accompanying chart. G.T. Glazier, as District Manager, Yellowknife, assumed responsibility for all branch staff located in the Northwest Territories and provided needed direction to the enforcement program. M.R. Robertson assumed responsibility for Fishery Management following my appointment as Branch Chief in May, 1972. C.T. Hatfield, who previously headed the Mackenzie Valley Pipeline Study, left the branch in April and was succeeded by J.N. Stein. Additions to the staff during 1972 included R.F. Peet (Stream Management), K.V. Weagle (Multiple Water Use), W.A. Bond and D.V. Gillman (Lake Management), R.W. Martin (Surveys); and V. MacRoberts, B. Mattock, E. Ralf and D. Green (Enforcement).

The branch moved into new quarters late in 1972, in the newly completed Freshwater Institute building on the University of Manitoba campus. The new building offers a significant improvement in facilities, and although branch staff are scattered over several floors, greater coordination of the branch effort will undoubtedly be possible.

The pace of industrial development in the North continued unabated in 1972. Commencement of the Mackenzie Highway added a new dimension to branch studies on that river system. The absence of adequate biological and hydrological data have made the problems of habitat protection all the more difficult, while the time frames imposed have strained the resources of the branch considerably. Work on hydro power proposals in the N.W.T. and on the Churchill-Nelson basin in Manitoba, as well as initial planning for pipeline studies in the Eastern Arctic, have also

required additional effort.

In fishery management, increased emphasis was given to assessment of the sports fishery in the N.W.T., and also to management of Arctic char stocks. There were indications of overfishing in certain of the trophy sport fisheries and assessment of this was considered to be a high priority. There was also increasing pressure to exploit Arctic char stocks, primarily for commercial sale, and an assessment of selected river systems was considered essential to the establishment of realistic harvest quotas.

Enforcement effort has been dispersed to reflect the new areas of emphasis. Increasing attention was paid to environmental problems in the Mackenzie Valley, and to monitoring the activities of industry. An office was established in Inuvik as a base for operations in the Mackenzie Delta area. Plans were developed for establishment of a base in the Eastern Arctic, probably at Frobisher Bay, and another at Fort Simpson.

Two new boats were acquired, one for Great Slave Lake and one for Great Bear Lake. The M.V. 'Johnny Hoe' was taken to Great Bear Lake and performed there for the major part of the season, as did the M.V. 'Taltheilei' on Great Slave Lake. These boats are being used jointly by Fishery Management and Enforcement Divisions, for both patrols and servicing field camps and check stations, as well as for biological sampling. With the inclusion of Conservation and Protection staff within the branch, efforts were made to more completely integrate their activities with those of the rest of the branch. One important part of this was to increase the flow of information to officer staff, so that they would be better informed on all phases of the branch effort and could relate this to the public in the field.

Continuing contact with the N.W.T. Government and with staff of the Department of Indian and Northern Affairs has permitted development of more effective working relationships with each of these agencies. Meetings were held with both commercial and sport fishing interests in the Northwest Territories to discuss cuss problems of mutual interest. Establishment of an Advisory Committee for Great Slave Lake provided a forum for discussion of problems affecting the fishery on that lake.

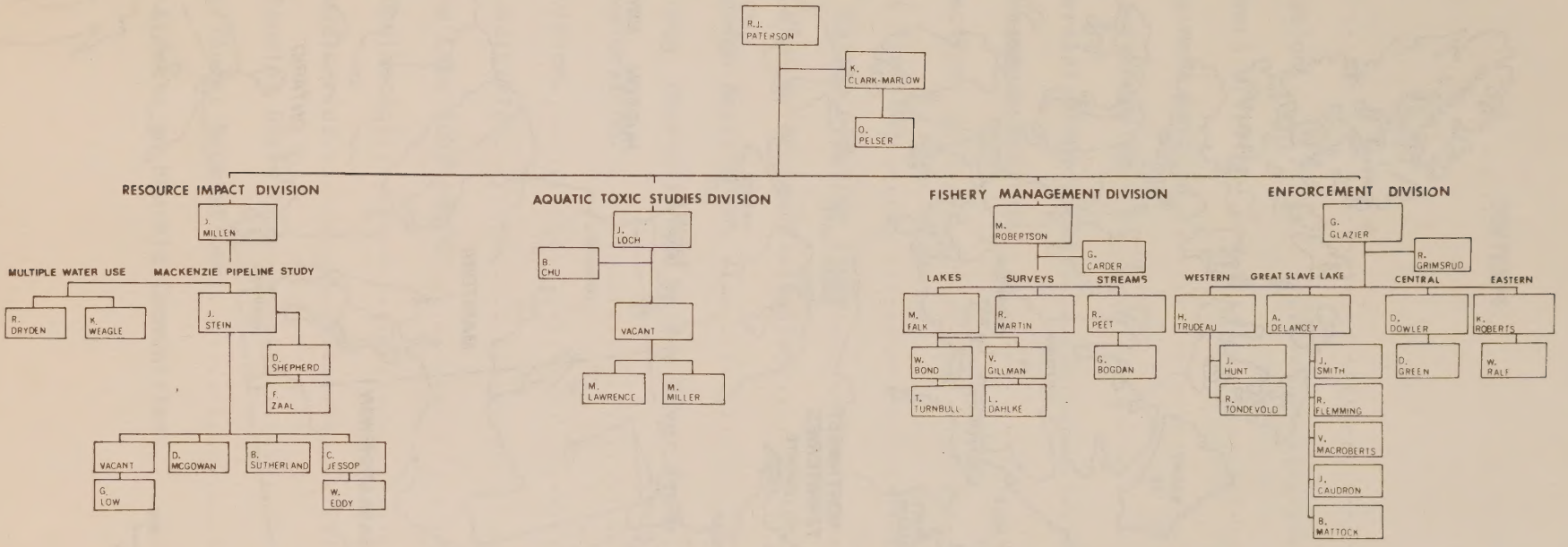
Within the provinces, the branch continued its participation in the Peace-Athabasca study - mainly a coordinating and advisory role for the fisheries studies. The public report on the project work was completed and received final review late in 1972.

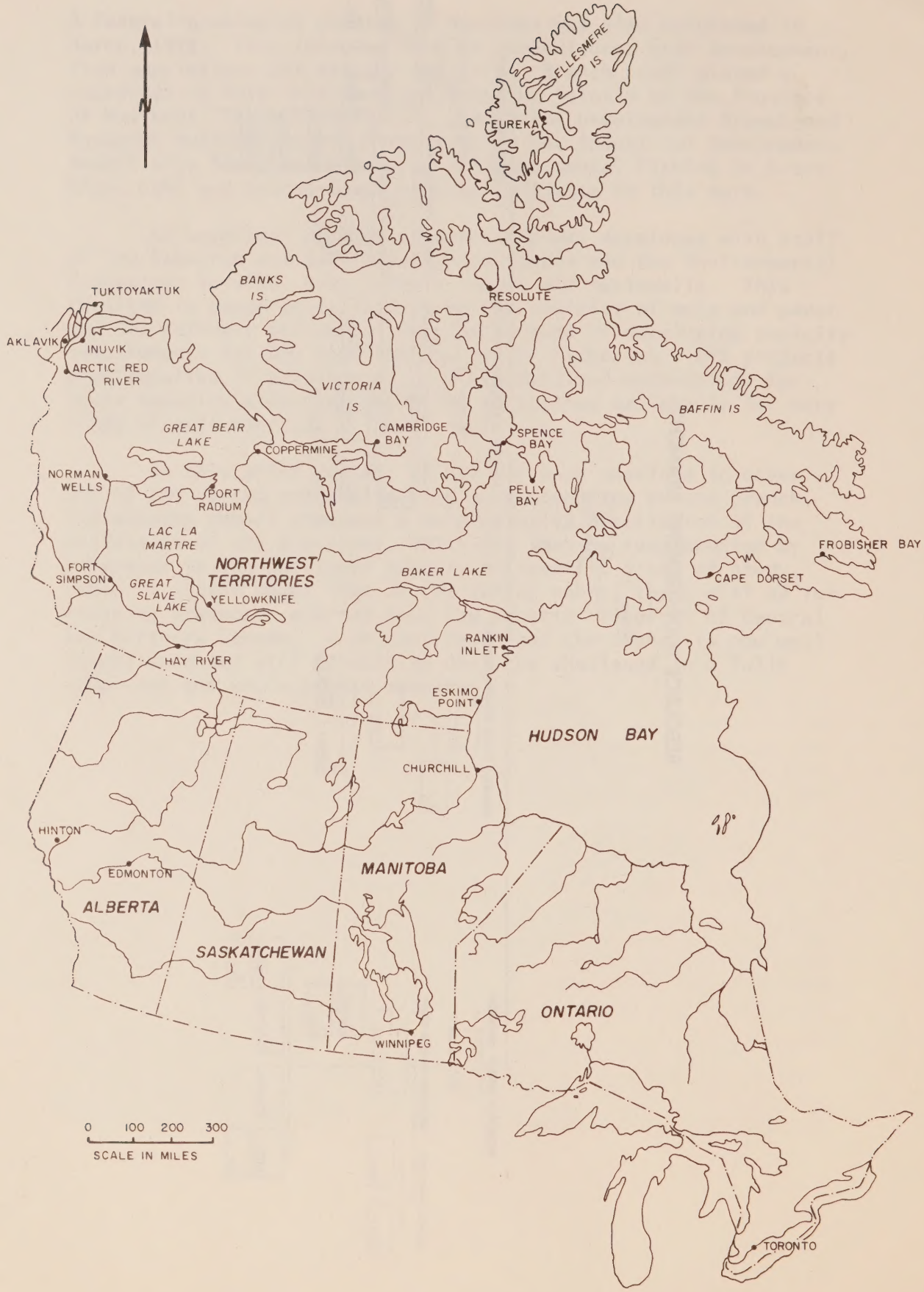
A federal-provincial program in Manitoba was also completed in March, 1972. This included work on aquaculture, gear development, fish populations and mercury analysis. Branch staff played a coordinating role in a program conducted jointly by the Province of Manitoba, Inspection Branch, Industrial Development Branch and Research and Development Directorate. The Industrial Development Branch also conducted a program of experimental fishing in Great Slave Lake and branch staff provided guidance in this work.

An excellent working relationship was developed with staff of the Research and Development Directorate and the Environmental Protection Service, both in this region and nationally. This resulted in cooperative studies on the toxicity of pulp and paper and oil refinery effluents, for the purpose of developing toxicity requirements for new regulations. Joint Fisheries - EPS projects also resulted in development of a standardized methodology for acute toxicity bioassays which may be applied nationally for many kinds of pollutants.

In this brief review, it has not been possible to cover all of the varied and challenging work conducted by the branch. The ensuing report provides a more detailed description of the activities of the divisions, which may then be supplemented by reference to the published reports on specific areas of study. There is little doubt that in the coming years, there will be increasing pressures exerted upon the aquatic resources of Central and Northern Canada. I am confident that the branch is now well established and will be able to meet the challenge in a fully competent and professional manner.

RESOURCE MANAGEMENT BRANCH

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PORT RADIUM
PELLY BAY
LAC LA MARTRE
FROBISHER BAY
FORT SIMPSON
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FISHERY MANAGEMENT DIVISION

M.R. ROBERTSON, HEAD

The Fishery Management Division is responsible for the development and operation of a management program controlling exploitation of the fish and marine mammal populations of the fresh and salt waters of the Northwest Territories, and the tidal waters of Manitoba and Ontario. The Division also plays a consultative and co-ordinating role in certain federal-provincial programs.

The group is broadly divided into Lake Management, Stream Management, and Survey sections. Divisional activities include investigations into the distribution, life history, and population dynamics of various fish species; assessment of their exploitation by domestic, commercial, and sports fisheries; and inventory of water bodies to recommend developmental direction. Results of investigations are used to establish quotas, to assess and update regulations, and to develop a fishery management rationale for the optimal utilization of the aquatic resources of the region. As the northern area covers some 1.5 million square miles and contains many anadromous, freshwater, and marine species about which little is known, the operational problems of the Division are unique.

LAKE MANAGEMENT SECTION

SPORT FISHERY UNIT

D. V. GILLMAN

L. W. DAHLKE

Sports fishing within the Northwest Territories is on the increase. As more leisure time becomes available and the fish resources of the area become more accessible the number of resident and visiting anglers will increase. The Sports Fishery Unit was established to assess the sports fish populations, to determine angler harvests and to provide management solutions that will ensure the long term survival of the fish stocks.

GREAT SLAVE AND GREAT BEAR LAKES

During 1971 a field program under the direction of T. Turnbull was established to assess the effects of concentrated lake trout fisheries occurring at independent private lodge operations on Great Bear and Great Slave Lakes. A need for more information was evident and the program was expanded to six lodges in 1972, three on each lake. D.V. Gillman came on staff during June of 1972 and assumed direction of the creel census and biological sampling programs being conducted at the lodges on Great Slave Lake. L. Dahlke, who has recently been appointed as a sports technician, directed operations on Great Bear Lake in 1972.

Summer assistants were stationed at lodges to obtain daily information on the number of fish caught, released, and those retained for trophy, fillet or shore lunch purposes. These results are summarized in the following table. Biological information was obtained by sampling portions of the retained catch for length, weight, sex and maturity. Scale or otolith samples were also taken for age determination. Preliminary findings indicate a decline in the availability and overall size of trophy fish within the lakes. Most sub-Arctic lakes are characterized by low productivity and lake trout in particular exhibit slow growth and attain a very old age. These factors have led to the conclusion that the lake trout populations cannot withstand the present level

of exploitation. Regulations are being drafted to reduce the total harvest, thus providing protection for the resource base.

MACKENZIE RIVER

A substantial sports fishery for grayling and northern pike exists on portions of the Mackenzie River and from the outlet of Great Slave Lake downstream to Ft. Providence. An investigation was started in 1972 to determine the extent of harvest. The principal sources of exploitation are from a sports lodge in the area and anglers fishing near the Mackenzie Highway crossing point. In addition to estimating the total number of fish taken, attention was also given to the possibility that spawning segments of the various populations present were being over-utilized. Regulations are being recommended to restrict the areas fished and numbers of fish taken.

Annual angling statistics and sports fishery sampling, Great Slave and Great Bear Lakes, 1972.

Category	Great Slave Lake	Great Bear Lake
Number of anglers	705	995
Pounds angled	92,916	230,850
Pounds retained	44,610	103,098
Pounds eaten as shore lunch (part of pounds retained total)	9,644	11,940
Average catch per hour	0.76	0.44
Number of fish, creel census		
Lake Trout	5,063	16,389
Grayling	637	976
Northern Pike	257	68
Pickerel	16	-
Number sampled and average weight (brackets)		
Lake Trout	2,069(8.9)	1,050(6.6)
Grayling	62(2.1)	122(2.3)
Northern Pike	15(5.3)	5
Pickerel	18(5.7)	-

COMMERCIAL FISHERY UNIT

W. A. BOND

T. TURNBULL

Commercial fishing in the Northwest Territories began in 1945 when operations were confined to Great Slave Lake. While Great Slave continues to play a leading role, there has been a trend during the past decade toward expansion of commercial fishing to several lakes around Great Slave and to designated lakes in the District of Keewatin.

Although large fish populations have been discovered in the Northwest Territories, there is little knowledge of their productivity and sustainable yield. It is known that while these northern lakes may have a large standing stock, their productivity is low and the sustainable yield is small. In such cases a major risk of over-exploitation exists. Once a population is over-exploited, many years may be required for recovery. To ensure the presence of exploitable stocks over a long period of time it is essential to monitor the harvested stocks on a regular basis so that quota adjustments may be made which reflect changing conditions.

In 1972, the Commercial Fishery Unit consisted of a biologist, Mr. W.A. Bond, who joined the staff in July, and one technician, Mr. T.D. Turnbull. Ten students were employed to assist in the summer field programs. Mrs. C. Read was hired in October to read scales and assist in data analysis.

GREAT SLAVE LAKE

A commercial fishery has operated on Great Slave Lake every year since 1945. Whitefish and lake trout are the main commercial species while inconnu, pike and walleye make up the remainder of the catch. Gill nets of 5½" (13.9 cm) stretched measure have been the sole method of exploitation. Until 1948, the annual commercial quota was 4.2 million pounds round weight of all species marketed. Although this quota was never met, the

quota was increased to 9.0 million pounds of whitefish and trout in 1949. This quota remained virtually unchanged until 1971, at which time it was reduced to 4.9 million pounds.

Since its inception, the fishery has been monitored both by the Department of Fisheries and the Fisheries Research Board of Canada. The data collected provide a clear picture of the effect of the commercial fishery on the fish populations over its 28 year period. There has been a general decrease in production of whitefish and lake trout. Whitefish landings have decreased from 5.7 million pounds in 1950 to 2.3 million in 1972. Trout, which accounted for 4.0 million pounds in 1949, contributed only 0.2 million pounds in 1972. The catch per unit of effort and the average size have decreased appreciably for both species. The minor species, inconnu, pike and walleye, which made up only 4% of the commercial catch between 1945 and 1949, accounted for 13% of the total landings in 1972. Continued vigilance is required if these trends are to be arrested.

The efforts of the Commercial Fishery Unit on Great Slave Lake are aimed at obtaining those data considered essential to the efficient management of the fishery. During the summer, commercial fishermen are interviewed on the lake to assess the catch per unit of effort, species composition of the catch and cullage. Non-commercial species of fish from sets are sampled for age and growth. Data for the commercial species are collected in the fish plants. In addition, experimental gill netting assesses the population structure of the various species. Information is also being gathered on the catch per unit of effort and species composition of the winter fishery.

Results in 1972 indicate that the species composition of the fish community has changed considerably since the 1940's. Lake trout have been all but eliminated from the west end of the lake and there are indications that this process of elimination is continuing eastward. The absence of this predator appears to have benefited the burbot population, which is now increasing in the west end of the lake. The mean age of commercially caught whitefish has decreased to 10.5 from 13.1 in the late 1940's. Whitefish of age 12 or older made up only 27.1% of the commercial catch compared to 79.3% in the 1940's. The growth rate of whitefish has increased dramatically, especially in the more heavily fished western end of the lake. There is an indication that whitefish are maturing at an earlier age and that the sex ratio has been altered in favour of male fish. Since only long-term trends are useful in assessing changes in a fishery, it is intended that the present work will continue in future years.

Acknowledgement is due the following people who worked as summer assistants on Great Slave Lake in 1972: Mr. P. Meikle, Mr. W. Crawford, Mr. L. Enderud, Miss S. Domke, Miss M. Roberts, Mr. W. Snead, Mr. L. Cardinal and Mr. D. Delancey.

LAC LA MARTRE

Lac la Martre lies 140 miles northwest of Yellowknife, N.W.T. It has an area of 650 square miles and, since 1969, has supported a commercial fishery directed toward whitefish (which comprise 85% of the catch) and lake trout. The commercial quota on the lake is 250,000 pounds round weight of whitefish and trout. In addition to the commercial fishery, the domestic fishery claims a sizeable poundage, resulting in a substantial overharvest. Since the commercial catch must be transported by air to Great Slave Lake, it is only economical to ship jumbo whitefish and those less than three pounds are culled at Lac la Martre. Some sport fishing for lake trout has been carried out on a fly-in basis.

In 1972, the work at Lac la Martre included sampling the commercial fishery for age and growth data, and assessing the rate of cullage and catch per unit of effort. Population structure was examined by experimental gill nets. As well, the extent of the domestic fishery was determined. This program was carried out by two summer students, Mr. R. Maness and Mr. R. Janis.

The recorded commercial catch in round weight was 209,256 pounds of whitefish and 40,008 pounds of trout. The catch per unit of effort was 47 pounds of whitefish and 9 pounds of trout per 100 yards of 6¼" gill net per 24 hours. This represents a considerable decrease from 1969 when the catch per unit of effort was 107 pounds of whitefish and 54 pounds of trout. Whitefish from commercial nets had a mean fork length of 551 mm (21.7") and a mean weight of 2522.3 g (5.6 lb.). The majority of these fish were 9 and 10 years old. Trout averaged 622 mm (24.5") and 3183.7 g (7.0 lb.) in fork length and weight respectively. Cullage by the commercial fishery was about 70,000 pounds of whitefish and trout. It is estimated that the commercial and domestic fisheries removed more than 500,000 pounds of whitefish and trout from Lac la Martre in 1972.

Results of the experimental gill netting program indicate that the species composition of the fish community had not changed appreciably since 1969. Whitefish accounted for 59% of all fish caught while other values were: suckers - 21%;

trout - 17%; pike - 3%. As in 1969, 75% of all whitefish were between 440 and 570 mm.

The future of the Lac la Martre commercial fishery is undecided at present. The residents of the village have expressed interest in developing a sport fishery instead and this matter is presently under study by the N.W.T. government.

KAMINURIAK LAKE

Kaminuriak Lake has a surface area of 180 square miles and lies 115 miles west of Rankin Inlet in the District of Keewatin, N.W.T. On the basis of survey work done in 1967 it was decided that the lake could support a commercial fishery for whitefish and lake trout. Such a fishery was established and operated for the first time in 1972. Fishing began July 31 and the season ended September 19. During August, the fishery was investigated by Mr. P. Meikle, a summer student working with the Commercial Fishery Unit. Age and growth data for whitefish and trout were gathered from samples of the commercial catch. Catch per unit of effort was determined by interviewing commercial fishermen on the lake and from catch records.

Landings in 1972 totalled 34,000 pounds of whitefish and 28,000 pounds of lake trout. These fish were iced and flown to the cannery at Rankin Inlet. Whitefish had a mean fork length of 610.0 mm (24.0") and a mean weight of 3550.9 g (7.8 lb.). These fish were 14 to 29 years old with a mean age of 19.1 years. Lake trout averaged 614.3 mm (24.2") in fork length and had a mean weight of 3246.6 g (7.1 lb.). The average catch per unit of effort for the season was 32 pounds of whitefish and 21 pounds of trout per 100 yards per 100 yards per 24 hours. Daily values for whitefish varied from 87 pounds on August 4 to 2 pounds on September 8. Daily values for trout ranged from 63 pounds on August 17 to 2 pounds on September 8.

SANDY POINT

Sandy Point lies 90 miles south of Rankin Inlet, N.W.T., on the west coast of Hudson Bay. The commercial fishery here provides Arctic char for the cannery at Rankin Inlet. In 1972 the fishery began July 15 and ended September 10. Since very little biological data are available on these char populations the fishery was observed by Mr. P. Meikle of the Commercial

Fishery Unit during the first week of September. Age and growth information was collected from 102 char and an assessment was made of the catch per unit of effort.

During the first week of September the catch per unit of effort was 74 pounds of char per 50 yards per 24 hours. These fish had a mean length of 614.9 mm (24.2") and a mean weight of 2985.5 g (6.6 lb). Their mean age (determined from otoliths) was 8.9 years.

STREAM MANAGEMENT SECTION

R. F. PEET

G. BOGDAN

The responsibility of this section is to manage anadromous and resident stream-dwelling fishes within the Northwest Territories such that no population is overexploited and that the commercial and sports fisheries are not developed to the detriment of the native domestic harvest. This is to ensure that active people in the north have the option of retaining their traditional way of life.

Most activity is geared to the assessment of fish populations in order to determine quotas for utilization of the resource by commercial, domestic and sports fisheries. The main species that is commercially and domestically exploited is the Arctic char especially the anadromous form. With the sports fishery the main species are the Arctic char and the Arctic grayling.

At present, the efforts of this section are mainly concerned with the monitoring and investigation of commercial fishery exploitation of the Arctic char. However the Enforcement Division of the Resource Management Branch and the Northwest Territorial Government also provide help in the collection of catch data on various domestic and commercial fisheries. For example, in 1972, data were collected on the domestic fishery of

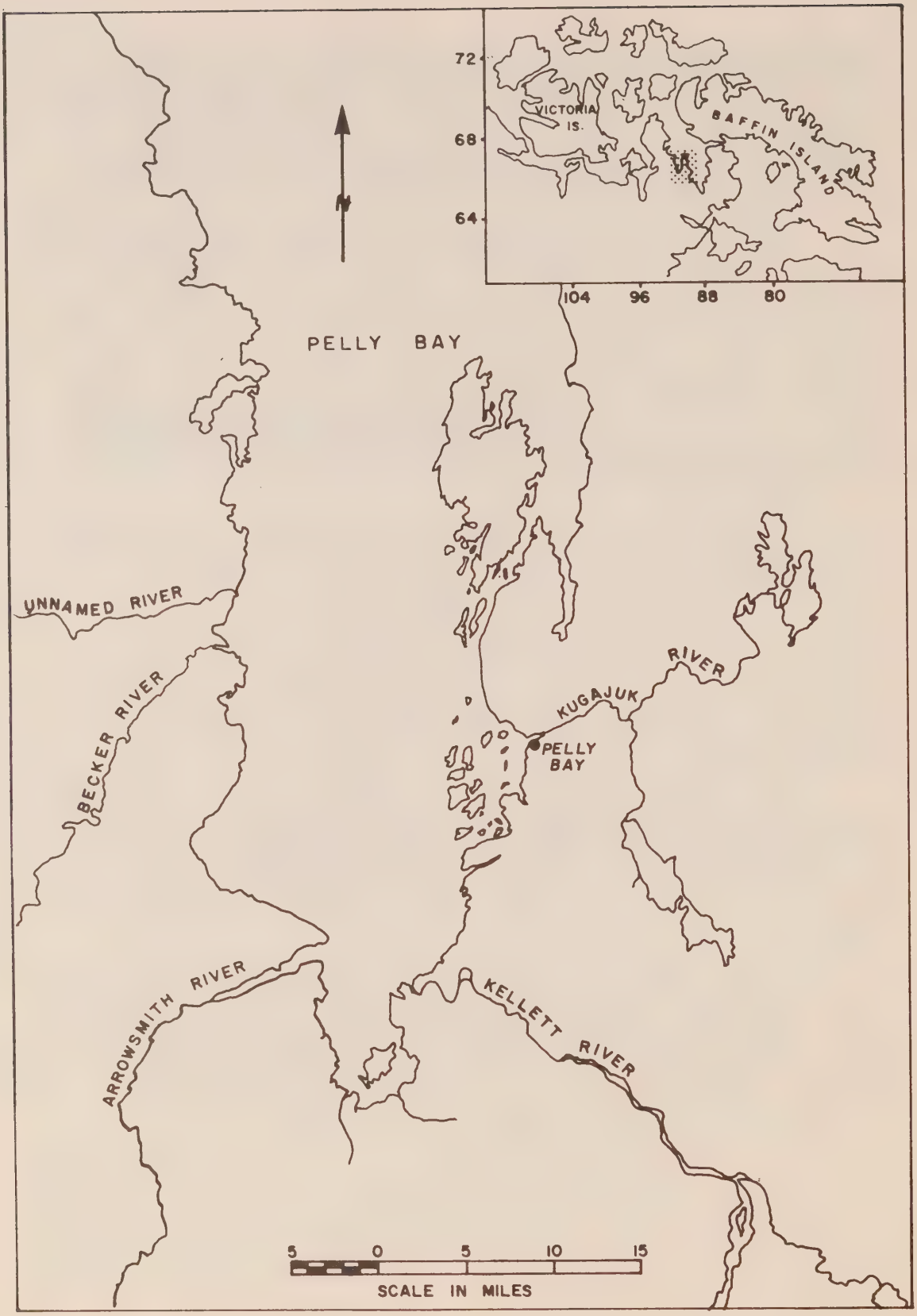
Minto Inlet and the sports fisheries at Tree River and Albert Edward Bay by the Enforcement Division. The Northwest Territorial Government provided catch information on a variety of fisheries throughout the territories, ranging from Cumberland Sound on the east coast of Baffin Island, to the Rankin Inlet area in Hudson Bay, to the Mackenzie River delta fishery.

To date, activities by the section itself have been restricted because there was only one permanent staff member assigned for most of 1971-72, Mr. G. Bogdan, Technician. Mr. R. Peet joined the Section as Biologist-In-Charge late in 1972. In 1971 and 1972 the majority of the effort centered around the Pelly Bay area where a two year survey of the Arctic char population was conducted in conjunction with the Field Surveys Section. The purpose of this project was to gather biological information on char for the establishment of quotas to ensure a continuing, viable commercial fishery.

In 1971 the survey was preliminary in nature and consisted of the collection of length, weight and age data from Arctic char at the mouths of the two rivers which were to be commercially fished (i.e. the Kellett and Arrowsmith Rivers). In 1972 the survey was more extensive and five rivers were surveyed with sampling and tagging at each one. In addition, fall sampling of the commercial catch on the Kellett and Arrowsmith River was carried out. The results of these surveys are presently being analyzed and will be incorporated into a Branch Report on the Pelly Bay area.

Short surveys were also done on the Taltson and Snowdrift Rivers in 1972. Both these rivers flow into Great Slave Lake. At the Taltson River an attempt was made to determine the size of the walleye population in that river. At Snowdrift the river was surveyed to determine its suitability as an Arctic grayling producer.

At the present time, pressure to exploit norther populations for sports, domestic and commercial use is rapidly increasing. Little is known of the basic biology of the various species, and this, coupled with the high costs of northern operations, the limited staff available, and the short field season make northern stream management work challenging and difficult.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SURVEYS SECTION

R. MARTIN

S. STEPHANSSON

Expansion of tourism and commercial fishing in the north, especially in recent years, has necessitated the development of a fisheries management program in the Northwest Territories. No inventory of the fisheries of the N.W.T. exists, and decisions are being made to exploit the fisheries resource without first assessing its capability. The control area quota system excludes the wide variation in biological production and fish species throughout this area. There was an obvious need for accurate and useful information for managing and planning the use of the N.W.T. fisheries.

A surveys section was developed in 1971 with three basic objectives:

1. to devise techniques capable of providing both an inventory and assessment of unexploited and exploited fish stocks throughout the N.W.T.

2. to obtain basic information on fish populations and related limnological and biological factors that directly affect fish populations.

3. to obtain basic information on the areas encompassing survey locations as related to suitability for fisheries development, i.e. aesthetic value, geographical features, recreational potential, etc.

With these objectives a sampling program was proposed and first applied during the summer of 1971. The major sampling effort was directed towards measuring the fish population characteristics as they actually existed, rather than what they should be according to present theory. Morphometry, water chemistry and biological stocks were sampled in an attempt to determine the limitations to fish production. Gradually, a classification of five groups of factors suitable for a fisheries inventory and assessment evolved. The five groups of factors

are: 1) morphometric, 2) edaphic, 3) biological, 4) landscape, 5) transportation and fisheries organization.

The first three factor groups need no explanation. The fourth refers mainly to the lake area's suitability for recreation and sports fishing. The fifth group is composed of the limitations to developing sports and commercial fishing industries. Transportation refers to access and cost of the required modes of transport. Fisheries organization refers to product markets and restrictive and legislative control through quotas, fishing gear, fish species and area restrictions. Factor groups 4 and 5 are required for determining both the fishery use and fishing pressure on the assessed fishing potential. Legislation, regulation and market demand may predetermine or limit fishery use of some waters i.e. excessive whitefish rate of infestation.

The 1971 field program consisted of spending approximately four days on each of a series of lake surveys. Five lakes were chosen throughout the N.W.T. In an attempt to sample a variety of watersheds, lake sizes and climatic regions. Little Doctor, Stagg, Harding, North Henik and Markham Lakes were assessed.

In 1972 the same general format was followed with some expansion and an increase from four to seven days in the field. The major expansion was with respect to lake sounding, gill netting and landscape (aesthetic) evaluation. Nonacho, Lady Grey, Duncan, Indin and Stark Lakes were assessed.

In addition to the lake surveys, the latter part of both summers was spent in the Pelly Bay area. A preliminary survey on two major rivers, the Kellett and the Arrowsmith, resulted in an expanded program in 1972. The purpose of the survey was to assess the Arctic char fish stocks in the vicinity of Pelly Bay, N.W.T. The expanded 1972 program was in conjunction with the Stream Management Section as mentioned previously.

Preliminary results from the 1971 and 1972 lake surveys indicate that the Mackenzie Valley waters are the most productive in fish species and growth rate. Fish species and growth rates decrease east into Barrens Lake and north into the Arctic. The central area should be restructured and the inventory and assessment method applied in areas with a fisheries development potential. The long-range planning of the Section is presently being prepared.

A survey was conducted by B. Wong on Hottah Lake in the Camsell River drainage. The July-August program was sponsored by the Government of the Northwest Territories in cooperation with

the Fisheries Management Division.

R.W. Martin was hired as the Section Technician in June, 1972. G.F. Bogdan and T. Turnbull, technicians presently in two other Management Sections assisted in the early stages of this Section's development. S.E. Stephansson continued planning the development of the Section through the summers of 1971 and 1972 and since the fall of 1972 as a casual employee.

RESOURCE IMPACT DIVISION

J.M. MILLEN, HEAD

The Resource Impact Division has responsibility for assessing and controlling the impact on the resource of proposed changes in physical habitat of fish. These changes are most commonly brought about by industrial development activities. Powers in the Fisheries Act to control these activities include requirements for the provision of fishways at obstructions, requirements for minimum flows at dams, requirements for the protection of spawning beds, and a provision prohibiting the deposit of debris and other material from logging and land clearing operations in streams.

The Division undertakes studies of fish resources where necessary for the evaluation of the impact of proposed developments and as a basis for recommending mitigation measures where required. Guidelines which set out good practise for such activities as temporary stream crossings and seismic work are prepared and issued. Close liaison is maintained with staff of the Enforcement Division who monitor activities in the Northwest Territories which may impinge on fish.

Most of the Division's activities are focussed on the impact of the ongoing and proposed industrial development of the Mackenzie Valley. In the past year contributions have also been made to the maintenance of fish resources of the prairie provinces.

Professional staff in the Division comprise six biologists and two engineers. A substantial technical support staff and temporary summer assistants complete the team. All staff are concerned with the assessment of impact on physical disruptions to the environment and development of recommended measures. However, biologists naturally assume the responsibility in predicting effects on the fish resources while engineering input is mostly

required in division mitigation measures such as fishways and alternative construction or operating techniques.

During 1972 Mr. C.T. Hatfield resigned from the staff, moving to the Pacific Region. Mr. Hatfield had been responsible for organizing the Mackenzie Valley Pipeline Study for Fisheries Service. His role as Head of this study was subsequently taken over by Mr. J.N. Stein. Biologists K. Chang-Kue and R. Porter joined the staff during the year and assumed positions in the Mackenzie Valley at Norman Wells and Fort Simpson. Mr. Ken Weagle transferred to the region from Newfoundland in June and commenced studies at Southern Indian Lake for the Lake Winnipeg, Churchill and Nelson Rivers Study.

MACKENZIE VALLEY PIPELINE STUDY

J. N. STEIN

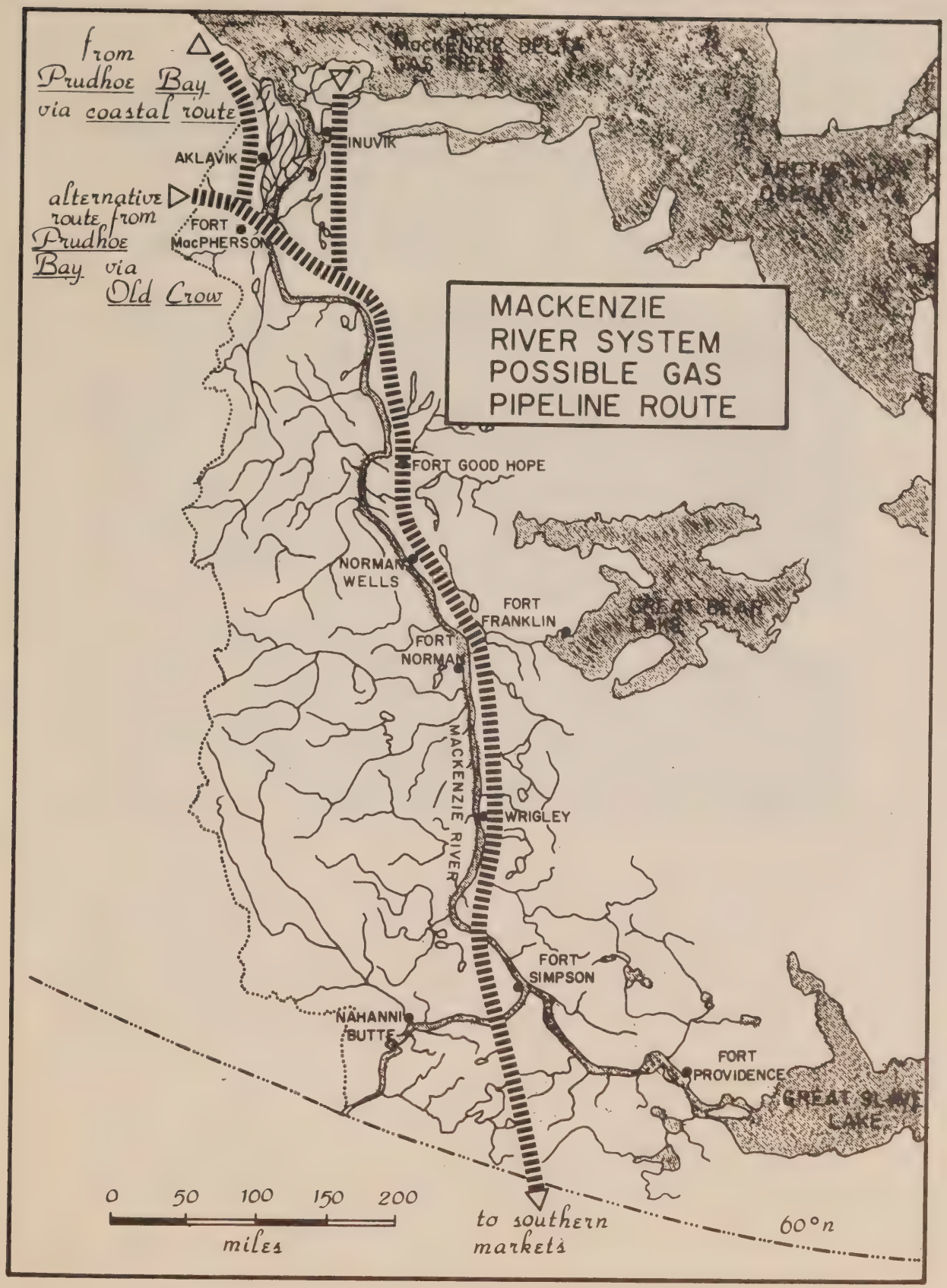
The 1968 discovery of oil and gas reserves in the Prudhoe Bay area of Alaska led to several feasibility studies for transporting these reserves to southern markets. Greatest consideration has been given to the construction of a pipeline to southern Alaska, from where oil would be shipped by tanker down the west coast, or alternatively, a pipeline following the mackenzie River valley through Northwest Canada and into Alberta. The former route has the approval of the United States Department of the Interior but the project is still held up by court action; nevertheless it will probably become reality.

Exploration of the Canadian Arctic, especially in the areas of the Mackenzie River delta and the Arctic islands, has more recently identified gas reserves considered sufficient to justify a Mackenzie valley gas pipeline. The possibility still remains that Prudhoe Bay gas may also be piped down the Mackenzie. Canadian oil deposits have been located, but since the extent of these deposits has yet to be determined, a gas line will most likely materialize first.

Any pipeline construction will pose a potential threat to the fish resources of the Mackenzie valley. Of greatest concern are the possibilities of blocking fish migrations, removal or siltation of spawning gravel, chemical or oil pollution of the aquatic environment and destruction of vital habitat by increased siltation.

The meager amount of information formerly available on the fish resources of the area did not permit the evaluation of proposed pipeline routes or construction techniques, in a manner that would ensure minimal disruption to the resource. Consequently, in May of 1971, the Resource Impact Division initiated a four year intensive investigation into the fish resources of the Mackenzie River valley.

Working from field bases in Aklavik, Arctic Red River, Fort McPherson, Norman Wells and Fort Simpson, sampling stations were located along much of the Mackenzie River and in most main


from Prudhoe Bay via coastal route
alternative route from Prudhoe Bay via Old Crow
MACKENZIE DELTA GAS FIELDS
INUVIK
AKLAVIK
FORT MacPHERSON
ARCTIC OCEAN
MACKENZIE RIVER SYSTEM POSSIBLE GAS PIPELINE ROUTE
FORT GOOD HOPE
NORMAN WELLS
FORT FRANKLIN
GREAT BEAR LAKE
FORT NORMAN
MACKENZIE RIVER
WRIGLEY
FORT SIMPSON
NAHANNI BUTTE
FORT PROVIDENCE
GREAT SLAVE LAKE
0 50 100 150 200
miles
to southern markets
60°n

stem tributaries. Netting crews determined the species composition and relative abundance of the fish populations at each station, while collecting samples for later determinations of the length-weight relationships, age and growth characteristics and food habits of abundant species. A tagging program was incorporated in 1972 as an aid in identifying fish migration routes and times. A synoptic helicopter crew was used to provide similar data for those tributaries beyond the reach of study bases.

Of the 34 species of fish encountered in the Mackenzie River system, Arctic char, lake trout, inconnu, humpback and broad whitefish, Arctic and least cisco, walleye and Arctic grayling appear to be those which could be most affected by pipeline construction. Reports to the Government of Canada, Environmental-Social Committee, Northern Pipelines, included specific recommendations for the protection of the resource during and after pipeline construction. Seasonal times during which the resources are most susceptible to disruption were delineated, as were fish populations requiring complete protection. Also included were measures for the protection of the substantial domestic fishery of the Mackenzie system.

Associated developments which have been proposed for the Mackenzie valley include the construction of an all-weather highway from Fort Simpson to Inuvik, dredging of the Mackenzie River navigation channel to allow use of a heavier class of barge, and the construction of a hydroelectric power scheme on the Great Bear River. Aspects of all these proposals which affect fish have been considered by the Division and some field investigations have been undertaken and preliminary recommendations prepared.

MACKENZIE HIGHWAY DESIGN EVALUATION

R. DRYDEN

On April 28th 1972 the Prime Minister of Canada announced the construction of the highway from Fort Simpson to Inuvik. The design and construction schedule was to be compressed into three years, with completion by 1975. The background studies of fish resources undertaken for the evaluation of pipeline proposals would have to be used for the highway. The major new factor introduced by a highway is the requirement to cross over streams where the pipeline may be buried under the stream bed. Observations of the effects of recent highway construction practice in the Northwest Territories had revealed that the passage of migratory fish through culverts was a critical problem. The practice had developed of crossing major streams with large culverts set on steep grades in substantial fills. The culverts were shown to be preventing highly desirable fish species such as grayling, pickerel and northern pike from reaching their spawning areas. The nature of these problems was pointed out to the Department of Public Works and a set of guidelines prepared for discussion with those responsible for the design of the highway. As the pipeline studies had not addressed this problem, all the information required to set fully appropriate guidelines is not yet available. Compounding the difficulty is the lack of hydrological data for the region, particularly for the stream sizes which it is most economical to cross by means of culverts.

As the highway design material is completed, copies of drawings and reports are submitted for review by the Division and recommendations are made mainly about stream crossings and other possible impacts of the highway on fish. To date, preliminary design material has been reviewed for the first 250 miles north from Fort Simpson. Detailed design including culverts has been reviewed for the first 50 miles.

FISHWAY DESIGN ASSISTANCE

R. DRYDEN

The knowledge and experience of the staff of the Division has been made available to assist with the solution to several fish passage problems in the region.

A schematic design was prepared for a vertical slot fishway at an irrigation water diversion dam on the Bow River, Alberta. The preparation of working drawings and supervision of construction was done by the responsible engineers of the Department of Regional Economic Expansion. Assistance was also given on the Peace-Athabasca Delta Project with the fish passage problem at the Quatre Fourches Lake level control dam.

For the Lake Winnipeg regulation control structure at Jenpeg, schematic drawings are being prepared for a fish attraction and holding device. This will ensure that the requrements for fish passage may be evaluated and met after construction of the dam.

LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY

K. WEAGLE

On August 24th, 1971 a federal-provincial agreement was signed initiating a program with the following objective:
"The purpose of the studies authorized under this Agreement is to determine the effects that regulation of Lake Winnipeg, diversion

from the Churchill River and development of hydroelectric potential of the Churchill River diversion route are likely to have on other water and related resource uses and to make recommendations for enhancing the overall benefits with due consideration for the protection of the environment."

The tasks assigned to the Resource Management Branch were studies of: 1) Fish Reproduction; 2) Commercial Fisheries and 3) Sport Fisheries. The first task included detailed mapping of spawning areas, collecting information on spawning behaviour (migration, numbers, depths, etc.) and identifying critical factors in recruitment. The commercial fishery study included calculation of catch/unit of effort, location of fishing grounds and determining age composition of the catch. Assessing the present and past value of the fisheries, estimating future values and estimating production costs for both the winter and summer fisheries were also required. Work on the sport fishery was to include location and success in sport fishing areas and an estimate of sport fishing potential. There are 5 study components as follows:

1. Outlet Lakes (Includes all the Nelson River Lakes from Warren's Landing to Split Lake).

2. Southern Indian Lake.

3. Diversion Route (Rat River and the Burntwood River and all the lakes thereon).

4. Lower Churchill (Churchill River downstream from Southern Indian Lake).

5. Lake Winnipeg.

During the summer and fall of 1972 data were collected on Southern Indian Lake. Studies covered the commercial and sport fisheries as well as an examination of the lake whitefish fall spawning run. Data on the commercial fishery included catch/unit of effort for the commercial species walleye, whitefish and pike; location of fishing effort and total production figures (landings and value to fishermen). Sport fishing data included catch/unit of effort for various areas of the lake. Records were kept on all sport fishing done by experimental fishing crews. During the whitefish spawning study data were obtained on the age composition of spawning fish, average number of eggs per female, preferred spawning substrate and depth, and the duration of the spawning season.

Field work was not done on the other 4 study areas, although a report is presently being prepared on the Outlet Lakes area. Data for this report were collected by the Manitoba Department of Mines, Resources and Environmental Management and by Dr. John Stockner, under the auspices of Manitoba Hydro.

Southern Indian Lake produces about 1,000,000 pounds of fish annually, with whitefish comprising 75%. In recent years the value to the fishermen has been approximately $130,000 per year. The whitefish are of good quality (Export standard) and are an excellent eating fish. In the summer of 1971 75 fishermen were on the lake while in the winter of 1971-72 there were 43 fishermen. Commercial catch/unit of effort ranged from 14 to 100 pounds/100yds of net/24 hours, and averaged 42 pounds/net/24 hours, during the summer of 1972.

Sport fish in the lake are whitefish, yellow perch, goldeye, sauger, walleye and northern pike. Sport fishing for northern pike in Southern Indian Lake is excellent with catch/unit of effort as high as 5.5 fish/rod/hr. (average length 65.5 mm; 5 lb). Pike were caught virtually everywhere with the largest angled fish weighing 20 pounds. Walleye angling was also good in some areas but were less abundant than pike. Catch/unit of effort of up to 9 fish/rod/hr. (average weight 22 ozs) were recorded, but no trophy size walleye (8 lb) were caught.

SEISMIC EXPLORATION

M. R. FALK

M. J. LAWRENCE

A recent increase in applications for permits to conduct seismic exploration in water bodies of the Northwest Territories prompted the Resource Impact Division to conduct a study to determine the effects that commonly used energy sources have on fish. The sources selected for study were: Aquaflex, a high explosive linear charge; 60 percent Geogel, a high explosive point charge

and a Par Air Gun, a non-explosive device. Study locations were the Middle Channel of the Mackenzie delta and Parsons Lake, a shallow water body east of the delta. The presence of seismic crews operating in shallow water (5 to 30 feet) made these locations desirable.

Various species of Coregonids were placed in metal cages at measured distances from the energy sources of known size and depth. After each shot, cages were retrieved and the fish determined to be alive or dead. Internal and external examinations were then conducted. A concept of measuring the lethality of toxic substances, the LC50 was used to predict the lethal range of the Aquaflex and Geogel charges. The term LR50, employed in the present study, was defined as the distance from the energy source where 50 percent mortality occurs.

LR50's at the surface resulting from the detonation of 165 feet of Aquaflex in 10 feet of water and a 10 pound charge of Geogel in 15 feet of water were 12.5 and 50 feet, respectively. Surface areas affected by these shots were 36,200 square feet for Aquaflex and 25,450 square feet for Geogel. Mortality to local fish in Parsons Lake from Geogel shots was in excess of 400 fish in an instance. In contrast no actual fish deaths were recorded for caged fish placed as close as 2 feet from a 300 cubic inch Air Gun. Further, no fish were observed dead during 100 miles of Air Gun shooting.

The results of this study reveal that the two high explosive energy sources examined are extremely lethal to local fish populations in shallow water. In contrast, a 300 cubic inch Air Gun was found to be harmless. This makes the Air Gun a favourable energy source for the protection of the fish resource. As a result, the use of high explosive energy sources in shallow offshore areas and inland lakes and rivers of the Northwest Territories is not being permitted, whereas the use of Air Guns is being encouraged.

ENFORCEMENT DIVISION

G.T. GLAZIER, A-HEAD
DISTRICT MANAGER

During 1972 Conservation and Protection Branch was incorporated into the newly formed Resource Management Branch as the Enforcement Division. The Division was then reorganized into four subdistricts, as outlined in the following figure, to give more responsibility to senior officers and to establish more of a presence in areas outside the immediate vicinity of Great Slave Lake. The officers in charge of each subdistrict are responsible for all fisheries enforcement within the subdistrict, so the environmental control section, which had been previously formed, was disbanded.

A permanent field station was established at Inuvik and additional stations are contemplated in other areas. The nature of the work being conducted in each subdistrict is outlined in more detail in the subsequent reports, submitted by the respective officer in charge.

LAND USE

Some overlap in the jurisdictional responsibilities of the Fisheries Service and the Water, Forests and Land Division of D.I.N.A. became apparent. An agreement was drafted between the two agencies in December to clarify our respective roles. In essence, it was agreed that the enforcement responsibility for stream crossing construction during land use operations would be handled by the Fisheries Service, in co-operation with the Land Use Inspectors. To avoid needless duplication of effort, it was further agreed that regular meetings between field personnel would occur, when such personnel are located in the same community. If a Fishery Officer is undertaking a patrol of a land use operation in an area not

EASTERN SUBDISTRICT
CENTRAL SUBDISTRICT
WESTERN SUBDISTRICT
GREAT SLAVE LAKE SUBDISTRICT
YELLOWKNIFE
HAY RIVER

staffed by this Department, he would undertake prior consultation with the Land Use Inspector to affect the desired co-ordination.

PROSECUTIONS

There were twenty-two prosecutions under the Northwest Territories Fishery Regulations and two under the Fisheries Act. Several prosecutions were frustrated due to weak and ineffective legislation. This problem should be alleviated by the new regulations presently in the draft stage.

Increased enforcement effort was directed towards anglers and the oil industry in particular. While fines and forfeitures were not significantly high, the effort was rewarded with an increase in angling licence sales and a general improvement in stream crossing construction.

The commercial fishing regulations were most in need of amendment, so that past year's activity was not as intense as is desirable. A new patrol vessel, presently under construction, and the proposed regulation changes have set the stage for much tighter control in the future.

COURSES AND CONFERENCES

Fishery Officers were enrolled in courses in introductory management, effective report writing, emergency measures and survival training. There is a limited need for these and other courses offered by the Bureau of Staff Training and Development, but a very obvious need for effective Fisheries Enforcement courses. The R.C.M. Police and Crown Attorney have been most helpful in training officers in courtroom procedures and the collection of evidence, but the need for more specialized fisheries enforcement training still exists.

PUBLIC RELATIONS

Increased use of news media, both radio and press, has led to a greater public awareness of the Fisheries Service in the Northwest Territories. It has been useful in conveying to the public our intent to seriously manage the fisheries resource through intensive surveys and concentrated enforcement. Individual fishery Officers are also being encouraged to make contact with local groups on regular basis to explain our activities in that particular area.

FISH OF THE NORTHWEST TERRITORIES

Lake Trout —
Great Bear Lake.

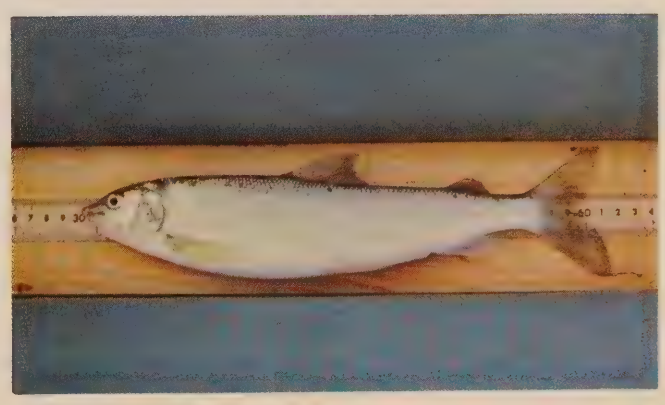
Lake Trout — District of Keewatin.

Arctic Grayling.

Chum Salmon — Mackenzie River.

Tagged Arctic Char.

Arctic Char — Fish Creek.



Rocky Mountain Whitefish.

SCENERY

Great Bear Lake.

Redcliff Is. — Great Slave Lake.

Arrowsmith River.

Harris River.

Hay River.

Martin River.

Mackenzie River Delta.

McNally Falls.

FISHERY MANAGEMENT DIVISION

Trophy Lake Trout — Great Bear Lake.

Taltheilei — Great Slave Lake.

Domestic Catch of Whitefish — Mackenzie River.

Sport Fishing Lodge — Great Slave Lake.

Johnny Hoe —
Great Bear Lake.

Hottah Lake.

Sealing — Bathurst Inlet.

RESOURCE IMPACT DIVISION

Culvert on Frog Creek.

Pipeline Construction.

Inuvik Pipeline Test Loop.

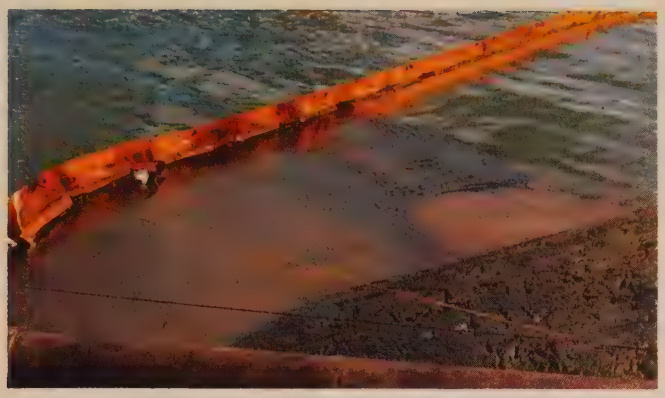
Pipeline Construction.

Peel River.

Mackenzie Highway Approach to Martin River

Fish Tagging Procedure

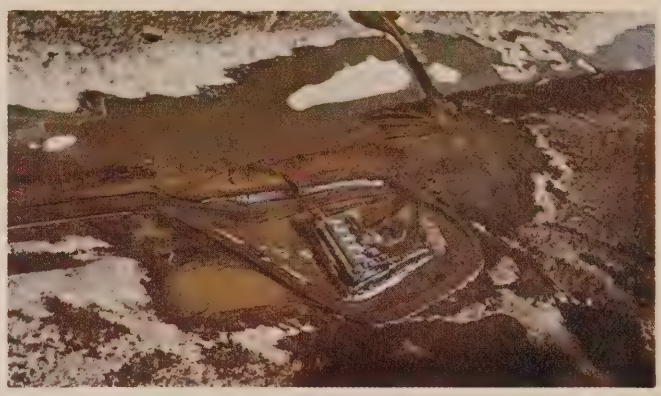
ENFORCEMENT DIVISION



Oil Spill near Yellowknife.

Removing Temporary Stream Crossing.

Flooded Drilling Rig — Mackenzie Delta.



Seismic Camp — Redstone River.

Winter Fishing near Aklavik.

Stream Crossing — Donnelly River.

Bombardier on Great Slave Lake.

Seismic Operation on Parsons Lake.

AQUATIC TOXIC STUDIES DIVISION

High Arctic Drilling.

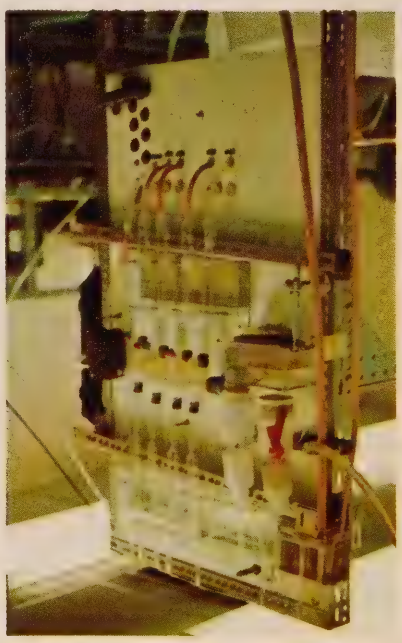
Benthic Sampling Apparatus.

Con Gold Mines — Yellowknife.

Prince Albert Pulp Mill.

Pulp and Paper Mill Outfall.

Bioassay
Diluting Apparatus.



Field Bioassay Apparatus.

SCENERY

Hay River.

Big Fish River Near Aklavik.

Louise Falls.

Mackenzie River Delta.

Pond Inlet.

Arrowsmith River.

Pingo in Mackenzie Delta.

Icebergs along Arctic Coast.

COMMUNITIES OF THE NORTHWEST TERRITORIES

Norman Wells.

Reindeer Depot.

Tree River — on Mackenzie R.

Arctic Red River.

Lac la Martre .

Rankin Inlet.

Yellowknife.

Pelly Bay.

STAFF CHANGES

During 1972 fishery officers B. Mattock, V. MacRoberts and E. Ralf were added to the staff at Hay River while Officer D. Green was taken on strength in Yellowknife. Officer W. J. Hunt was transferred from Yellowknife to Inuvik where he has been charged with the responsibility of setting up and manning a permanent office in that community.

WESTERN SUBDISTRICT

H. TRUDEAU

The major emphasis in this Subdistrict during the past year has been on environmental problems resulting from the concentration of oil and gas exploration activities along the Mackenzie valley, Mackenzie delta and the Arctic islands. To cope with these activities Officers J. Hunt and R. Tondevold were placed in Inuvik and Fort Simpson, respectively. Liaison with other Government agencies such as the Northwest Lands and Forest Service, Canadian Wildlife Service, Inland Waters Directorate and the Territorial Game Branch were established for cooperation in the field.

ENVIRONMENTAL PROTECTION

During the past year over 300 land use applications were processed. This was carried out in conjunction with the Land Use Advisory Committee with representatives from DINA, CWS, EPS and Fisheries Service. Following is a breakdown of land use applications processed between November 15, 1971 and December 31, 1972:

	Gas and Oil Wells	Seismic	Other
Fort Simpson	23	34	47
Inuvik	34	30	50
Arctic Islands	35	30	17
Totals	92	94	114

A copy of each application is sent to the Yellowknife Office by DINA. Each application is considered separately and the implications of each program are weighed against the available information on the area concerned. Recommendations are then made to the District Manager, based on the available information and within the scope of the Fisheries Act and Regulations. If approved by the District Manager, these recommendations are put before the Land Use Committee to be included in the operating conditions of the permit. Once the permit is issued and the program has

commenced, it then becomes a matter of monitoring and enforcing the restrictions throughout the construction and clean-up operations. In conjunction with the land use operations, N.W.T. Explosive Licences are issued under authority of the N.W.T. Fishery Regulations. This licence makes it possible to control the use of explosives in the waters of the N.W.T.

In the winter and spring of 1972 there were about 15 seismic operations in the Inuvik area. Each of them was visited periodically and aspects of each operation were inspected as they related to the Fisheries Act (i.e. stream crossings, garbage disposal and line clean-up while operating on ice). Some advances to completely eliminating the use of lumber on stream crossings have been made in that ice bridges are being used to a large extent only using logs for binding. Through cooperation with company representatives, stream crossing sites where the least damage would be expected were chosen. On occasion inspections were carried out in cooperation with Land Use Inspectors from DIAND, due to mutual interests in the various aspects of the oil and gas exploration programs.

There were six offshore programs in 1972 and each of them was visited at least once during their operation. Three of these operations (near Single Point, upper Delta and Eskimo Lake) used explosives. It was on the latter that a Fisheries representative was placed almost full-time in order to observe and suggest alternatives in the event of extensive fish kill. It was on this operation in the Eskimo Lakes that extensive fish kill did occur. As a result, the seismic activity was discontinued in that particular area. Operations were confined to areas where the fish populations were deemed less concentrated. Upon inspections of other operations using explosives, being that the areas were not known for heavy population of fish, the fish kill was minimal. In the order of 5 to 10 fish killed per day. At no time during inspections of operations using Air Guns were fish kills observed.

A problem encountered during the marine seismic operations was that of co-ordination of the seismic activity with that of the beluga whaling done by residents of Aklavik, Tuktoyaktuk and Inuvik. This problem was overcome readily by the companies agreeing to avoid the whaling area at the prime whale time.

During the past year the oil and gas exploration in the Mackenzie valley has been somewhat overshadowed by the tremendous volume of activity in the Arctic. It is to be expected however, that more attention will be paid to the southern N.W.T. as the construction of the pipelines becomes more imminent. There are 14 known gas wells which have been suspended or abandoned south

of the 67 parallel so far, and this area has barely been scratched.

These various finds have not appeared to be of commercial size in the past, but ready transportation in the form of a pipeline could change the whole outlook. Amoco has four producing wells in the Fort Liard-Pointed Mountain area at present and are drilling another this year. Limited drilling is underway in the mountains north of this area at present, but the cost of a well in this mountainous country is estimated at about $2 million. This will be a much better risk once the highway and pipeline are completed and as the price of gas goes continually higher.

The Mackenzie River valley is presently undergoing extensive construction activities with the building of the Mackenzie Highway and studies preparing for the construction of an oil and gas pipeline. The Dempster Highway is well under way with completed sections from Fort McPherson to Arctic Red and from Inuvik south, almost to the Rengleng River. Construction of the Mackenzie Highway began very quickly and with very little notice. There are 40 miles of right-of-way cleared north of Fort Simpson with approximately 7 miles up to grade. Although this rate of construction will probably drop somewhat, it requires constant monitoring and advanced surveillance of stream crossings along the route.

The Fort Liard Highway presently has 25 miles completed involving one river crossing of significant size. This crossing is on the Poplar River and was put in without consultation with Fisheries Service. This installation is very poor from a Fisheries point of view as it has blocked the migration of grayling. This emphasizes the need for constant surveillance of highway or other construction activities involving stream crossings.

There were several oil spills in the N.W.T. during 1972. An investigation of a spill in Yellowknife was carried out and assistance was given in the clean-up operation. This spill, as well as many of the others, resulted from negligence by the parties concerned. Although the decision was made not to prosecute on the Yellowknife spill, it is felt that this may ultimately be the only alternative to impress the companies with the necessity of updating handling procedures and implementing safety precautions.

Major oil spills reported in the N.W.T. during 1972 were:

Location	Type	Amount	Cause
Resolute Bay	Turbo-A-1	10,000 gals	Broken line
Spence Bay	Fuel oil	1,000 gals	Broken line
Yellowknife	Bunker C	5,000 gals	Overfill
Resolute Bay	Fuel oil	5,000 gals	Tank leak
Resolute Bay	Fuel oil	4,000 gals	Broken line
Hall Beach	Diesel fuel	Unknown	Tank leak
Rankin Inlet	Fuel oil	20,000 gals	Overfill
Frobisher Bay	Diesel fuel	4,000 gals	Tank leak
Cambridge Bay	Fuel oil	2,000 gals	Shipwreck
Glacier Bay	Diesel fuel	1,000 gals	Broken line
Inuvik	Fuel oil	30,000 gals	Overfill
Inuvik	Gasoline	600 gals	Truck accident
Holman Island	Fuel oil	30,000 gals	Open valve

The above figures are not a complete list as many spills are not reported, i.e. spills in conjunction with seismic operations, etc.

Travel throughout the N.W.T. on trips associated with the oil and gas exploration industry has been extensive. In the Eastern Arctic, Rankin Inlet, Eskimo Point, Chesterfield Inlet and Coral Harbour were visited. In the Central and High Arctic, trips were made to Cambridge Bay, Resolute Bay and Eureka and in the Western Arctic, Fort Liard, Fort Simpson, Norman Wells, Arctic Red River and Inuvik. Each of these trips involved hundreds of miles of travel in small aircraft. The purpose of this travel included monitoring the various activities and representing the Department to Industry, Government agencies and the public in general.

COMMERCIAL FISHERY

There has been a history of failure from attempts to fish commercially in the Mackenzie delta. However, the Holmes Creek Commercial Fishery in its first year proved to be an opportunity to confront the initial problems associated with such a venture. Hopefully this project will commence July 1st, 1973, reach the quota and according to a market survey, have no problem in disposing of the fish locally. Following is a record of the expense, fish production and expected revenues.

Holmes Creek Fishery 1972

Material and Supply		$ 3,629.00
Building and Equipment		13,000.00
Transportation		1,700.00
	Total	$18,329.00

First year catch record: September 9, 1972

48 boxes x 50 lbs	Dressed Whites	2,400 lbs
1 box x 26 lbs	Dressed Whites	26 lbs
1 box x 75 lbs	Large Dressed Whites	75 lbs
8 boxes x 60 lbs	Pan Ready	480 lbs
1 box x 68 lbs	Pan Ready	68 lbs
6 boxes x 60 lbs	Round Whites	360 lbs
7 boxes x 15 lbs	Whitefish Fillets	105 lbs
1 box mixed	Dressed Whites and Round Whites	18 lbs
	Total	3,554 lbs

Paid out to fishermen	.25/lb	$1,181.00
Wages to filleters and camp support		1,496.00
	Total	$2,677.00

Expected revenue from fish sales in Inuvik $2,500.00

A winter commercial fishery is about to start on the Sitidgi and Eskimo Lakes. This has been attempted before with moderate success. Another attempt will be made in 1973 with a 3,000 pound quota. The project appears to be laid out in a well organized manner, utilizing the local market. A winter commercial Char fishery is being looked into in the Hershel Island area. Hershel Island is in the Yukon, however, the market for these fish would be in Inuvik. A recent request to start a summer commercial fishery near Tuktoyaktuk has been made. Further details on this project are not available. Mr. Frank Rivet of Aklavik has commercially fished in the West Channel of the Mackenzie River for several years with his main catch being Inconnu and his vendors being Aklavik and Inuvik.

DOMESTIC FISHERY

In the delta communities of Aklavik, Arctic Red River and Fort McPherson extensive quantities of fish are taken for human and dog consumption. In the order of 50,000 pounds of whitefish were taken during the 1973 fall run in Arctic Red River. From observations, fishing occurs year round in the East Channel running adjacent to Inuvik. Some of the Inuvik locals jig in the smaller channels of the Mackenzie River catching as many as 50 burbot in a day. The burbot are for human as well as dog consumption.

Time has been spent at each of the whaling stations (East and West Whitefish Station) conversing with the locals about the catch and whaling procedures. The people of Aklavik frequent East Whitefish Station most often recording a catch of about 33 beluga in 1972. The people of Tuktoyaktuk frequent West Whitefish Station; they report a catch of about 45 whales in the 1972 season. The beluga whales are used domestically only, utilizing the whale for its muk-tuk and meat. The procedure to date for hunting the beluga whale has been to shoot the animal, then attempting to harpoon it. Using this procedure only 50-60% of the animals are retrieved. In the coming season it is intended to spend time with the people to learn, as well as suggest that the hunting procedure be reversed thereby eliminating the senseless slaughter of the animals.

Statistics are currently being compiled on other domestic fisheries as well as the whaling and seal harvests in the Western Subdistrict. Following is a summary of the domestic beluga whale harvest to date:

	Áklavik West Whitefish Station	Tuktoyaktuk Kugmallit Bay	East Whitefish Station
1972	33	45	35
1971	30	3	49
1970	?	75	?

SPORTS FISHING

With increased population, industrial development and tourist activity in the Inuvik area, the sport fishing scene was probably more active in 1972 than any year previously. A great deal of time was spent in the public relations field. Meetings

with oil company personnel, seismic company supervisors and party managers, pipeline committees, government personnel and delegates from Canada and the U.S.A. dealing with environmental problems in the North have been numerous.

PROSECUTIONS

There were five prosecutions in the Western Subdistrict during 1972. Three were angling offences; all resulting in convictions with fines ranging from $5.00 to $20.00. The other two were charges laid against two oil exploration companies; both of which were convicted and fined $100.00 each. The amounts of the fines in all cases were insignificant. However, the resultant publicity may act as a deterent to others and demonstrate our intention to enforce the Fisheries Act and take legal action when necessary.

GREAT SLAVE LAKE SUBDISTRICT

A. DELANCY

Most winter patrols in this Subdistrict are carried out by bombardiers and aircraft on the various lakes since very few lakes are accessible by truck. Three bombardiers patrolled Great Slave Lake during the winter of 1972. Two of these machines are stationed at Hay River and one at Yellowknife. All outlying lakes are patrolled by aircraft and skidoo in the winter and by aircraft in the summer.

GREAT SLAVE LAKE

The summer operation on Great Slave Lake was patrolled by

two vessels stationed at Hay River and Yellowknife. Aircraft was used whenever necessary. Over the past three years there has been a marked decline in men and equipment involved in the commercial fishery. This information was obtained through a questionnaire answered by fishermen involved in the fishery. Great Slave Lake production therefore, has shown a definite decline.

KAKISA LAKE

Kakisa Lake yielded 48,068 lbs of walleye. This was a native fishery conducted solely by the residents of Kakisa Lake. Fish were freighted into Hay River by Mr. E. MacKenzie, a resident of the Kakisa settlement.

TATHLINA LAKE

A total of 66,105 lbs of walleye were caught by the natives from the Kakisa settlement. A portion of the fish was freighted by Carter Air Service and the balance by Mr. MacKenzie.

THEKUITHILI LAKE

Between 4 and 8 fishermen caught 190,577 lbs of whitefish and lake trout from this lake. Mr. Ray Baert air freighted this fish to the Hay River fish plant during the winter. The summer operation freighting was done by Mr. Baert to the Simpson Island fish plant. Fish were then transported to Hay River by the Marketing Corporation packer.

SPARKS LAKE

After attaining the Thekulthili Lake quota, fishermen moved into Sparks Lake. Between October and December 4 fishermen caught 52,218 lbs of whitefish and trout. Fish were flown to Hay River by Mr. Baert.

DOG FACE LAKE

This small lake lying to the southeast of Tathlina Lake was fished by one man during October. Only 1,290 lbs of walleye of the 5,000 lb quot were taken.

McDONALD LAKE

Eight fishermen caught 35,486 lbs of trout and whitefish during the latter half of September. Fish were transported to the Simpson Island fish plant for shipment to Hay River by the Corporation's fish packer. They were then air freighted to Hay River.

LAC LA MARTRE

This is a native fishery where 20 natives took 242,619 lbs of whitefish and trout during July and August. Fish were processed at the Lac La Martre plant, then transported to Hay River via Wool Bay.

PROSECUTIONS

There were 12 cases successfully taken to court. However, there were a number of cases dropped due to improper wording of the Regulations.

GEAR DEVELOPMENT

The Industrial Development Branch of the Department of Environment did considerable test fishing with seines and trawls in an effort to produce fish which would be fresher and of greater value on the market. Captain Andrew Flett was sent to advise in the operation of the new gear which would be put aboard the forty-foot vessels of Mr. Frank Hirst and Mr. Fred Mueller. These men and their vessels were retained by contract by the Industrial Development Branch for the entire summer operation. Their vessels were equipped with the necessary gear for the operation. However, the daily catch of this gear was less than that produced by gill

nets. This gear may be of a greater value in the future under different circumstances and a different fishery. The whitefish may not always be the most sought after commercial fish since northern pike and inconnu are bringing ever higher prices on the market.

CENTRAL SUBDISTRICT

D. H. DOWLER

Activities in this Subdistrict during the past year have been largely concerned with the commercial, domestic and sports fisheries. Specific areas of emphasis were Great Slave Lake, Great Bear Lake and the Arctic coast. There was little involvement with mining and related activities.

GREAT SLAVE LAKE

The winter fishery activities on Great Slave Lake were light, with only one small commercial outfit operating out of Yellowknife. The catch from this outfit was sold locally. Since the Freshwater Fish Marketing Corporation has discontinued fish collecting facilities on the north side of the lake for the winter season, effort has been cut drastically. Activity in Areas 5 and 6 consisted of one outfit in the Union Island area and three near Et-then Island. The latter fished the areas around Pekanatui, Redcliffe, Pearson Point and along the east side of Pethei Peninsula. Two seasonal guardians, Fred McCordic and Peter Sangris, were employed for the winter season and covered these areas by bombardier. Travel on the lake in the east arm was difficult due to the presence of numerous pressure ridges. A total of 3,500 miles of patrols were completed by bombardier. Officer Tondevold completed one patrol through the east arm with

Guardian McCordic. The commercial season was extended into April with little significance or benefit to the fishermen. There were no inland lakes fished in this area during the winter season. Local lakes, reserved for angling and domestic fishing, as well as commercial areas, were checked regularly by air patrols.

The majority of patrols by boat and aircraft centered on the east arm sports fishery. Any spare time was devoted to checking commercial fishermen operating mainly out of Wollf Bay. On extended patrols, fishing activity of all kinds was checked. A sangstercraft covered about 3,000 miles on patrol and was operated by Sangris and myself, assisted by Officer Tondevold. Officer Green reported for duty August 21 and took part in later patrols. No prosecutions occurred as the result of patrols, although several warnings were issued in some suspect cases. There is no way to measure the effectiveness of a patrol unit's presence or absence from the scene, but indications are that when we were around with a fast boat, most fishermen operated within the regulations.

GREAT BEAR LAKE

This was the first season that Great Bear Lake has come under my direct supervision. A new boat, the Johnny Hoe, was purchased for joint Enforcement-Management use on the lake. Officer James Caudron was the captain for the season. His crew consisted of Guardian Victor Beyonne and Management Technician Lother Dalke. Some good ground work was done by Caudron and his presence was certainly known by some of the lodge operators and anglers. However, much time in boat patrols was spent becoming familiar with the area, harbors, reefs and personnel at the lodges. Some difficulties were encountered by late arrival of gas supplies, and minor mechanical problems. Some coverage was accomplished by air patrols which will have to be greatly expanded next season. We are in the process of planning co-ordinated air and boat patrols for next season.

PELLY BAY

Since my area of supervision has been officially expanded to include Pelly Bay, a visit was made to Pelly in May in company with officials of Industry Development Branch of Territorial Government. This was done as a liaison trip to discuss future fisheries development. Another patrol was made during midsummer

and was followed up by Officer Green spending two weeks at Pelly Bay during the fall fishery. This fishery was not a success due to the inability to locate char in the usual holes and only 5,592 lbs were produced. The Becher River was also fished and produced 1,771 lbs. Fishery management crews worked on the Kellett, Arrowsmith and unnamed rivers entering Pelly Bay, as well as some preliminary surveys on proposed inland lake fisheries. The results are eagerly awaited by those concerned.

CAMBRIDGE BAY

This area was covered during several patrols taking in areas of the Cambridge Bay Co-op commercial fishery, Arctic Outpost sports fishing camps and the area around Cambridge Bay. The commercial fishery produced the following for the year:

Anadromous Char, four rivers	107,767 lbs
Land-locked Char, 13 lakes	39,586 lbs
Inland Whitefish and Trout, 2 lakes	30,417 lbs

Quotas were slightly exceeded in one or two instances, but in general, Development Officer Merkley did a good job of controlling production. He was always cooperative and helpful.

Ron Shepherd was employed for the season at Arctic Outpost camps and continued collection of data as in previous years. He arrived at camp on July 21 with Officer Trudeau and set up a new tent frame. No particular enforcement problems occurred, but considering the attitude of camp management, some infractions no doubt would have occurred if a man was not present. Particulars from this operation have been submitted in detail in a separate report. This is an area where a comprehensive assessment of the char runs should be undertaken. The fishing pressure in this area will increase in the future and there is a need to establish feasible quotas for each river system.

KUUJJUAR RIVER - MINTO - HOLMAN

Two attempts were made during the summer to check the sports fishery on the Kuujjuar River but were not accomplished because of adverse weather and more pressing situations in other localities. Arrangements were made with two Holman Island residents to keep records of the sport fishery (Nicholas Uluaruik) and the fall domestic fishery (David Kanayok). This was quite

successful and indicated a harvest of 21,441 pounds in the domestic fishery and about 2,275 pounds from the sport fishery. The domestic fishery continues to be excessive and steps should be taken to contact and convince the local residents to take less fish.

TREE RIVER

Enforcement and collection of data continued this year with Guardian Jim Hunt working at Tree River for the entire season. There were no particular problems; however, control of this fishery would be impossible without the continuous presence of a Department representative. A metal storage building was set up with equipment and supplies stored on site. Eskimo domestic fishing on the river was minimal and the overall fishery appears to be slowly improving. A paper on the history of the Tree River fishery was prepared by Mike Robertson and myself for presentation at the Annual Canadian Committee on Freshwater Fishery Research in Halifax.

During the course of patrols to areas of specific activity, spot checks and liaison visits were made at Bathurst Inlet, Melville Sound, Spence Bay, Fjoa Haven, Coppermine, Point Lake, Harding, Duncan Watta and Hearne Lakes, Fort Rae, Snowdrift and Hottah Lake. As previously mentioned, patrols by boat and bombardier covered 3,000 and 3,500 miles, respectively. In addition, over 12,000 miles were covered in chartered aircraft and about 2,000 miles on local patrols were covered by truck.

DOMESTIC FISHERY

Control and accurate records of domestic harvests of fish continues to be a problem in all areas. The effort and demand fluctuates with local economic ventures and welfare projects. To offer any figures would be perhaps misleading but the general trends in some settlements can be assumed from such things as use of skidoos in place of dogs or movement of people from one place to another. In very general terms, consumption of fish in the following areas can only be assessed as follows:

Fort Rae	-	decreased
Yellowknife	-	slightly increasing
Snowdrift	-	decreasing

Coppermine	-	decreasing
Pelly Bay	-	decreasing (fish not available)
Cambridge Bay	-	decreased (fish from Co-op fishery used)
Rae Lakes	-	constant
Holman Island	-	slight decrease

Since the returns from local Development Officers have not come in there is little information on the seal harvest. For export tax returns, which would only cover those animals sold to the Hudsons Bay Company, for 1971-72 indicate the following figures:

Coppermine	-	2,000
Holman	-	1,000 (actually in excess of 6,000)
Cambridge Bay	-	233
Spence Bay	-	892
Pelly Bay	-	659
Gjoa Haven	-	249

In all of these areas, most skins are used by Co-ops for handicrafts and would not be included in tax returns.

SPORTS FISHING

The summer season began with the usual scramble of anglers to the local hot spots at Martin Lake and Mosquito Creek near Yellowknife. Reports of excessive catches of walleye and the use of illegal gear prompted an investigation. Seven prosecutions under the N.W.T. Angling Regulations quieted things down considerably and resulted in a significant increase in angling licence sales. Patrols to these areas were done by Officers Trudeau, Tondevold and myself, assisted by Guardian Sangris.

With present plans to use and secure the services of Territorial employees in various locations, a much better record of fish harvest can be kept. A specific effort should be directed in the future to establish a reliable source of data on all settlement fisheries, without which management is meaningless. The perennial problems of shortage of qualified staff during the busy summer season continued to cut down the effectiveness of enforcement coverage in local angling fisheries as well as those on Great Slave and Great Bear Lakes. The addition of Officer Green to Yellowknife staff and our operations with a permanent boat on

Great Bear Lake will certainly help. Assistance from Officers Trudeau and Tondevold was most helpful. The establishment late in 1972 of four Subdistricts within the Territories was a welcome step towards a comprehensible organization as far as field staff were concerned. With close cooperation and communications between the Officers in charge, a good sound and productive field force should evolve.

EASTERN SUBDISTRICT

K. ROBERTS

Activities in the Eastern Subdistrict during the past year were mainly concentrated in the Rankin Inlet area of the Keewatin, otherwise emphasis was directed towards gaining a working knowledge with the area and an understanding of the problems.

RANKIN INLET

The Rankin Cannery operated in the summer of 1972, using char from the Eskimo Point area and whitefish from Kaminuiak Lake. The char fishery based at Sandy Point produced a total of 18,000 pounds. This was comprised of 8,644 pounds from Ferguson River, 5,327 pounds from Eskimo Point-Wallace River, and 4,171 pounds from Sandy Point area. This fishing started on August 11 and ceased on September 9. After this date weather forced a closure due to poor flying weather. A total of 12 fishermen took part in this operation, operating 6 canoes. The camp at Sandy Point, the collecting point for the char, was well run. Portable coolers and ice makers were working well and camp was clean.

Due to lack of information the Rankin Cannery were unaware that lake trout would have trouble passing inspection due to high

mercury content. Therefore, out of those trout shipped to Rankin a large percentage were unfit for shipment. As a result, the trout were dumped and bagged at the lake site to be used later for fox bait.

KAMINURIAK LAKE

At Kaminuriak Lake the fishery undertaken by 8 men using 4 canoes started on August 1 and ended September 19. A total of 23,416 lbs of lake trout and 27,972 lbs of whitefish were recorded. These catches were apparently recorded in a very haphazard manner, an example being that no trout were shown as landed for a 7 day period, however, during this same period whitefish were still being landed. A large part of the Kaminuriak operation was very unorganized. Equipment such as coolers, ice makers and general camp equipment did not operate properly. As a result managers at both ends of the fishery, as well as the Eskimo fishermen themselves, ended up rather disgusted. At this time it is unknown whether this fishery will be attempted again in 1973.

BAFFIN ISLAND

In early 1972 a patrol was made to the Baffin Region with stops at Frobisher Bay and Pangnirtung. At this time the N.W.T. Government was planning to start a commercial fishery at Nettilling Lake. The lake limit of 20,000 pounds would be taken at the end of one fiscal year and start on the next, obtaining a 40,000 pound catch. These plans never materialized. Later contact with Frobisher Bay showed no further interest in any commercial fishery on Baffin Island. Other Baffin settlement fisheries are used for domestic purposes.

A survey was made of the old camp of Canadian Fish Producers at Nueltin Lake, all buildings and equipment in the site was noted as to condition and photographs along with this report sent to Winnipeg. The Ennadai warehouse was checked and all equipment found in good order. Ovention gas stocks require replenishing.

SPORTS FISHING

The bulk of the sport fishery in the Eastern Subdistrict was comprized of fishing camps between Great Slave Lake and Hudson Bay. For the most part these camps appeared to be well run with managers and owners aware of the conservation aspect. The placement of a guardian or officer in these camps for spot checks for at least a week at a time should be considered for this coming season.

AQUATIC TOXIC STUDIES DIVISION

J.S. LOCH, HEAD

The Aquatic Toxic Studies Division has been recently established in response to a growing need for biological expertise on the toxic effects of pollutants on the aquatic resource. This need has been expressed initially in the National Effluent Regulation Program of the Canada Department of the Environment, whereby regulations are being promulgated under the Canada Fisheries Act which regulate the discharge of "deleterious substances" from various classes of industry (eg. the pulp and paper industry). Clauses that pertain to toxicity of industrial effluents are being incorporated into these regulations. Fisheries Service has recognized its responsibility to provide its requirements for inclusion in these "toxicity clauses".

In 1972 studies were carried out on effluents from the pulp and paper, mining and oil refining industries on the drilling fluids used in oil and gas exploration.

These studies have included both field "pollutant-effects" work and laboratory acute toxicity bioassays. Effluents from such places as Port Radium (N.W.T.), Hinton (Alberta), Toronto and even Oklahoma have been studied, either in the field or the laboratory or both. This work has resulted in proposed toxicity clauses for both the pulp and paper and oil refining effluent regulations, an accelerated interest in the toxicity of drilling wastes and possible future Fisheries input into the base metal mining guidelines.

It is the intent of the Division to continue studying various kinds of industrial effluent to determine their effects on the aquatic resource. The necessity of such a program has been recognized by Ottawa, and consequently Fisheries and Marine Service - Operations and Research and Development Directorates have established a co-operative Industrial Toxicology Program which is centred at the Freshwater Institute, Winnipeg.

NATIONAL EFFLUENT REGULATIONS

J. S. LOCH

PULP AND PAPER MILL EFFLUENT

A short term co-operative study on regulatory bioassay procedures for the Pulp and Paper Effluent Regulation was initiated by three agencies of the Canada Department of the Environment. These were the Environmental Protection Service (E.P.S.), Fisheries Service - Operations Directorate and Fisheries Service - Research and Development Directorate. Separately, these agencies did not have the resources or expertise to accomplish such a study. The study was performed at the Freshwater Institute.

The main objective of the project was to define the most appropriate regulatory bioassay test for practical and enforcement of regulations. This was accomplished by determining the gross effects of temperature, aeration, flow conditions, effluent storage temperature and fish size on acute toxicity bioassay procedure. Another objective of the project was to determine the toxicity of prairie province mill effluents in relation to the degree of waste treatment practised at each mill. A third objective was to develop and illustrate appropriate statistical procedures for analyzing bioassay data so as to ensure scientific validity of regulatory bioassay tests for legal purposes.

The results of this study were as follows: neutralization of pulp mill effluent (P.M.E.) reduces its acute toxicity; temperature of the bioassay influences the acute toxicity measurement in such a way that the higher the temperature the greater the toxicity; a flow-through bioassay was more sensitive and reliable than a static bioassay; the toxicity of P.M.E. varied between mills and even after secondary treatment; a single concentration flow-through bioassay module was developed.

PETROLEUM REFINERY EFFLUENT

The Canada Department of the Environment is developing effluent regulations for the petroleum refining industry. These regulations will include an acute toxicity limit to fish. A

joint project was established between Fisheries Operations, Central Region and Fisheries Research (Freshwater Institute) whereby an insight into the toxicity limit and bioassay test procedure could be gained. This project was conducted with close consultation with the Environmental Protection Service (E.P.S.).

Effluents from six Canadian oil refineries were bioassayed for acute toxicity using rainbow trout, fathead minnows and guppies. These refineries were suggested by E.P.S. as being representative of a range of current waste treatment practices. In addition, acute toxicity bioassays were performed with a formulated effluent prepared using the concentrations of ammonia, phenols, sulphides and oils which E.P.S. has suggested as being levels attainable by the industry.

Results and conclusions from the study were:

1. There exists in Canada at the present time, at least two refineries whose effluents did not kill rainbow trout in standard 96-hour flow-through bioassays and which appear to utilize sound waste practices.

2. The formulated effluent did not kill rainbow trout in the standard flow-through bioassay.

3. Therefore, Canadian oil refineries employing sound waste treatment, including good housekeeping, can produce effluents which are not acutely toxic.

4. Since repetitive sampling of a single effluent was not within the scope of this study, it is not possible to determine the frequency with which Canadian oil refineries can produce effluents which are not acutely toxic.

The results of this study were used as the basis for the Fisheries Service's requirements for the purposes of the oil refinery effluent regulations. These requirements are presently being discussed with E.P.S. and the petroleum industry.

POLLUTANT EFFECTS ON BENTHIC COMMUNITIES

J.S. LOCH
L.GREGORY

Benthic fauna are very useful in assessing the effect of a pollutant on an aquatic environment for several reasons: their differential but specific sensitivity, their long life cycle and their relatively sedentary mode of life. However the analytical methods are not well enough refined at this time. Qualitative comparisons consist merely of noting the relative abundance of pollution-sensitive organisms (such as Ephemeroptera, Trichoptera and Plecoptera) and pollution-tolerant fauna (such as Oligochaeta, Hirudinea and some Chironomidae). However, this is not sufficient due to inadequate knowledge concerning the sensitivity of the various benthic families, genera or species. The usual qualitative comparisons are accomplished by diversity indices. Diversity indices are however a single parameter measuring both the number of species (or genera) present and the relative abundance (evenness) of each without taking into account the actual identity of the various taxa. Interpretation of the indices can therefore be ambiguous. Information analysis removes this ambiguity. It is a hierarchial method of analysis in which individuals are progressively fused into groups of increasing size, the groups being fused by their similarity in attribute structure. The quantitative presence or absence of all species in all samples are thereby considered.

The preceding methods were used to determine the effects of the effluents from the Abitibi Manitoba Paper Company on the Winnipeg River benthos, the Prince Albert Pulp and Paper Company on the South Saskatchewan River and the Imperial Oil Refinery on the Red River.

Both analytical methods were found to be useful in assessing the effects of industrial discharges on the benthos in the receiving waters. Information analysis permitted identification of areas on the river bottom showing varying stages of pollution-effect. These areas could be correlated with certain benthic communities. The diversity indices allowed comparison of diversity above and below outfalls and also permitted insights into seasonal effects on the pollution status of the receiving waters.

KEY TO THE CHIRONOMIDAE OF THE WINNIPEG RIVER

J. S. LOCH
P. STEWART

In the process of sorting and identifying benthic samples from the Winnipeg River it became apparent that genera identification of the members of the Chironomidae family was difficult. Therefore a project was initiated to provide a photographic identification guide to the various sub-families of the Family Chironomidae (O. Deiptera) with specific reference to the identification of genera which were poorly treated in other identification guides and keys examined. Modern teminology and accepted nomenclature were to be applied to the genera treated.

The guide was intended as an aid for novices in Chironomid identification and therefore it was agreed that characters which were found to be most useful in our own identifications would be included in the guide.

Photography of the Chironomid genera from the Winnipeg River benthic survey was carried out from September to December. About 300 negative photographs were taken, from which 200 - 250 were processed as prints and filed as to the genera involved. A taxonomic key to the various genera of two of the Chironomid subfamilies, the Tanypodinae and the Chironomidae was then compiled. The key was based largely on labial tooth and plate characters. The purpose of the key was to direct the reader to areas of the identification guide which contained more specific information about the individual genera. However, the use in the key of verbal description of subtle differences in tooth character became quite cumbersome and lost its usefulness as more genera with similar tooth characters were considered.

An alternative to the verbal key which is currently being worked on, is a pictorial key, using drawings of the labial plates and associated characters to direct the reader to the pertinent sections of the key. Drawings in ink of pertinent features of all of the Winnipeg River genera were then completed. Additional genera from the collection at the Freshwater Institute have been drawn as well and genera not contained there are being sought after.

MOBILE BIOASSAY LABORATORY

J. S. LOCH
W. LAKE

The conventional method for obtaining test effluent for toxicity determinations often involves shipping large volumes of effluent over long distances to a central laboratory usually far removed from the sample site. Some of the problems inherent in this procedure are: detoxification of the effluent, inability to assess variability in effluent toxicity and the necessity to ship large volumes in order to conduct flow-through bioassays. A mobile bioassay laboratory was designed, constructed and tested during 1972 in an attempt to resolve these problems. Bioassays were run in the mobile lab at ambient and controlled temperatures and in static and continuous flow modes, using oil refinery effluent as the test material and rainbow trout and fathead minnows as the test organisms.

MINING OPERATIONS IN THE NORTHWEST TERRITORIES

M. R. FALK
M. MILLER

Comprehensive assessments of the effects of mine waste disposal on aquatic biota were carried out on four mining operations in the Northwest Territories during 1972. These were: Giant Yellowknife Mines Ltd and Con (Cominco) Mines Ltd. near Yellowknife; Echo Bay Mines Ltd. at Port Radium; and Terra Mining and Exploration Ltd. on the Camsell River. Studies included determination of effluent toxicity as well as water quality, metal con-

tamination of fish and sediment and benthos diversity in the receiving water bodies.

Both Giant and Con Mines are gold mining and milling operations and have been in production since 1948 and 1938, respectively. Despite intensive water quality studies on arsenic contamination in the past 10 years no specific biological investigations have been undertaken. A serious water pollution problem arising from the Giant Mine operation was clearly defined. Effluent entering Yellowknife Bay on Great Slave Lake was acutely toxic to both local fish species and Canada's standard bioassay fish, rainbow trout. High levels of arsenic, copper, zinc and cyanide are believed to be the cause of this. A substantial area of Yellowknife Bay was found to be affected with high levels of arsenic, zinc, copper and nickel present in the sediments. Benthos was limited in this area and exhibited very low diversity. Fish, however, were not adversely affected except for an absence of major fish species in the immediate vicinity of the discharge. Since Great Slave Lake supports viable domestic, commercial and sports fisheries, the implication of continued discharge by the Giant Mine are great.

In contrast the impact of the Con Mine on Great Slave Lake appears to be minimal at this time. The biological effects of mine waste contamination has been limited to several inland lakes. These lakes were characterized by a sparse benthic community exhibiting low diversity. High levels of arsenic, zinc, copper and nickel were found in the fish, water and sediments of these lakes. The final discharge point in Yellowknife Bay was not similarly affected.

The Echo Bay and Terra Mines are silver-copper mining and milling operations of recent origin. Effluent from the Echo Bay Mine is discharged directly into Great Bear Lake without any containment or treatment. High levels of lead, zinc, copper and uranium were found in the sediments adjacent to this operation. Benthos in this region was limited but not unlike most areas of the lake. Both water and fish sampled off the discharge point contained heavy metals which were not above background. High turbidities in the area caused by the effluent are believed to have an adverse effect on the fish and benthic communities but restricted to a small area due to a high dilution factor.

Effluent from the Terra Mine is discharged into a small lake adjacent to the Camsell River. Analyses of water, sediments, benthos and fish above and below the final discharge point indicated no adverse effects from the mine wastes on the Camsell River.

Studies of this nature will be undertaken in the future by the Environmental Protection Service. Fisheries Service will, however, continue its involvement in setting toxicity limits and ensuring that recommendations arising from the 1972 N.W.T. mining study are put into effect.

TOXICITY OF PETROCHEMICAL DRILLING WASTES TO FISH

M. R. FALK
M. J. LAWRENCE

The recent increase in petrochemical drilling operations in the biologically rich, but sensitive, Mackenzie River delta has caused concern that drilling wastes may have an adverse effect on the fish resource. The current practice of waste containment is within an excavated sump. Upon completion of the operation the sump is backfilled and incorporated into the permafrost. The Mackenzie delta is subject to flooding and constant erosion of its banks. As a result, waste fluids may be carried into the river system. In addition, artificial islands and drilling vessels are currently being planned for offshore drilling. In view of the implications of increased drilling activities in the Mackenzie delta area an assessment of drilling waste toxicity was carried out during 1972 in co-operation with the Arctic Petroleum Operationers Association.

Drilling fluids have a variety of functions including cooling the drill bit, bringing cuttings to the surface and preventing cave-ins and blowouts. They are composed of many substances each having a specific function. Major components of drilling fluids include benbonite clay, ferrochrome lignosulfonate, carbony-methyl-cellulose, sodium acid pyrophosphate, barium sulphate, caustic soda, to mention a few. Very little is known of the chemistry of the resulting mixture and its effect on fish.

Through field and laboratory investigations drilling fluids

and many of the constituent chemicals were found to be acutely toxic to fish. Sump fluids were comparatively less toxic but not acceptable for release without prior treatment. It is therefore being recommended that sumps located in areas subject to flooding be afforded with adequate dykes to contain drilling wastes. It is also recommended that in the event that sump fluids are to be discharged into water bodies the waste be treated and rendered non-toxic to fish. Future studies in this area will be carried out by Fisheries and Marine Service and E.P.S. and will include defining the scope of the problem, determining long-term effects of waste disposal and effective means of waste treatment.

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